

Wales. Project Report No OCS9323 MAFF Chief Scientist Group pp 1-93.

- Boag B. Palmer L. F., Neilson R. & Chambers S. J. (1997). Distribution, prevalence and intensity of earthworm populations in arable land in Scotland. *Annals of Applied Biology* 130, 153-165.
- Boag B., Jones H. H., Evans K. A., Neilson R., Yeates G.W. & Johns P. M. (1998). The application of GIS techniques to estimate the establishment and potential spread of *Artioposthia triangulata* in Scotland. *Pedobiologia* 42, 504-510.
- Boag B. & Yeates G. W. (2001). The potential impact of the New Zealand flatworm, a predator of earthworms, in Western Europe. *Ecological Applications* 11, 1276-1286.
- Murchie A. K. & Gordon A. W. (2013) The impact of the "New Zealand flatworm", *Arthurdendyus triangulatus*, on earthworm populations in the field. *Biological Invasions* 20, 569-586.

How does an introduced vertebrate host species affect the risk of Lyme disease?

Characterising Grey squirrels (*Sciurus carolinensis*) as tick hosts and reservoir hosts of *Borrelia burgdorferi* s.l. in Scotland

Caroline Millins¹, Amelia Brereton², Alissa Edoff¹, Lucy Gilbert³, Roman Biek¹

¹University of Glasgow,

²University of Aberdeen,

³James Hutton Institute

E-mail: c.millins.1@research.gla.ac.uk

Lyme borreliosis caused by *Borrelia burgdorferi* sensu lato (*B. burgdorferi* s.l.) is a tick-transmitted bacterial zoonosis which is maintained in a complex tick-wildlife cycle. In Scotland, Lyme borreliosis is of increasing concern as numbers of human cases have risen sharply in the last decade. The introduction of a competent reservoir species may modify local disease dynamics and increase the risk of Lyme borreliosis to humans, by increasing the number of infected ticks in an area.

Grey squirrels (*Sciurus carolinensis*) were introduced to the UK approximately 100 years ago and have become widely established. The current population is estimated at over one million with at least 200,000 grey squirrels present in Scotland (Fig. 1). Previous research on a small number of

animals has shown that they are competent reservoir hosts for at least two genospecies of Lyme disease, *Borrelia afzelii* and *Borrelia burgdorferi* sensu stricto. So far the role of grey squirrels as tick hosts and *B. burgdorferi* s.l. reservoir hosts in Scotland has not been quantified.

Research objectives are to; 1) Quantify and characterise the tick parasite community of grey squirrels. 2) To quantify the prevalence of *B. burgdorferi* s.l. infection in grey squirrels by testing both tissues and by xenodiagnosis (testing tick larvae which have fed on squirrels). 3) To carry out objectives 1 & 2 at regional and national scales in Scotland. 4) To quantify the genetic diversity of *B. burgdorferi* s.l. from grey squirrels using multilocus sequence typing (MLST).

Preliminary results indicate that infection prevalence in squirrels is much higher than in native rodent species, and that squirrels are infected with a diverse range of species of *Borrelia*, confirming this species potential role as a reservoir host for *B. burgdorferi* s.l. in Scotland. Squirrels are frequently infested with larval and nymphal stages of *Ixodes ricinus*, also known as the deer or sheep tick (Fig. 2) and the main vector of Lyme borreliosis in the UK. Further analysis is underway to understand the spatial, temporal and host drivers of *Borrelia* infection in grey squirrels.



Fig.1. Grey squirrel (*Sciurus carolinensis*). Photo credit: Aileen Adam.



Fig. 2. *Ixodes ricinus*, adult female. Photo credit: Christina M. Berry/ University of Bristol.